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# Detection of 4-point Bend Induced Micro-cracks in CFRP Laminates via Coda Wave NDE

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Although coda wave NDE has been shown to have some sensitivity to realistic damage in concrete structures, the technique's capability for detecting micro-cracks in fibrous composite materials has yet to be evaluated. This paper reports on the first investigation of realistic damage, specifically micro-cracks, in fibrous composite materials using coda wave differential signal features. Micro-cracks were generated in CFRP samples using the 4-point bending configuration shown in Fig. 1. The damage was monitored during loading with Acoustic Emission, and the loading was stopped after each significant damage event. The damage was then examined with coda wave NDE, immersion UT, and micrographs. This work demonstrates the capability of coda waves to detect and monitor micro-cracks in CFRP laminates. Coda wave sensitivity, repeatability, and reproducibility is presented and discussed.

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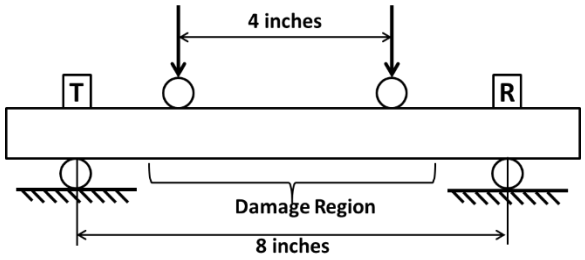


**Figure 1.** Schematic of 4-point bend configuration to generate microcracks.

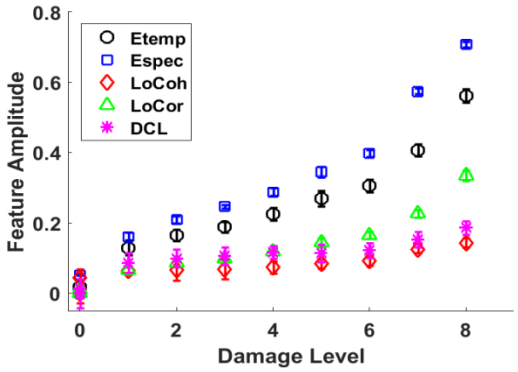


**Figure 2.** Differential feature amplitude increasing with increasing damage level. Damage Level corresponds to AE MARSE.